

Annual Equivalent Value, Benefit Cost Ratio, and Composite Performance Index as Valuation Appraisal Support of Teakwood Plantation

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Abstract

Teak (Tectona grandis L.f) is a premium high-value hardwood species being viewed as the most preferred species for investment opportunity. Recently, there has been a gradual move away from state control of teakwood plantation toward the participation of private enterprises. Several enterprises offer investment opportunity of teakwood plantation in which one of the main selling points being offered is a quick harvesting schedule. A quick harvesting time, however, might not provide the best outcome to the investors. This research exercise and compare the valuation appraisal of different harvesting schedules. The research focused on project planning, enterprise budget, financial projection, and valuation measurements to arrive at overall appraisal. To avoid any possible bias of individual investor's preference on common valuation criteria such as total investment, net cash flow (NCF), net present value (NPV), internal rate of return (IRR), profit on investment (P/I), and payback period (PBP), 3 others criteria namely benefit cost ratio (BCR), annual equivalent value (AEV), and composite performance index (CPI) have been applied to arrive at a more fair valuation. It is concluded that the longer the harvesting schedule, the better valuation outcome could be achieved, and therefore, investors should critically review any investment proposal in accordance to their preference on valuation criteria.

Keywords : annual equivalent value, benefit cost ratio, composite performance index, valuation appraisal

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Introduction

Several authors suggested agricultural expansion to meet additional food due to population growth led to deforestation and environmental degradation (Amacher *et al.* 2008; Fuglie 2010; Kangalawe & Lymo 2010; Quaye *et al.* 2010). Benhin (2006) stated that deforestation in developing countries was the cheapest way to increase agricultural production. Despite the need for productive agricultural lands there are unproductive marginal drylands scattered all over the world that have not been developed mainly for economic reasons. The drylands that cover about 41% of the Earth's land surface support approximately 36% of the human population (Washington-Allen *et al.* 2010). Despite extensive research on dryland agriculture such as in Morocco, Israel, Iraq, Chile, USA, Iran, and Australia (Ryan *et al.* 2007; Rabia *et al.* 2008; Abi-Ghanem *et al.* 2009; Young *et al.* 2010; Acosta-Martinez *et al.* 2011; Carberry *et al.* 2011; Kademani 2011), none of them were dealing with teak plantation in marginal dryland as it was studied by Sugiharto (2013).

Sugiharto (2013) studied the communities' preference and financial benefits between standalone teak plantation

and intercropping other commodities in between teak plantation. Similar intercrops farming in between teakwood plantation were carried out in India in which teak plantation were successfully intercropped with *Oryza sativa* (Lalramghinglova & Jha 1996). In Ghana, teak trees were inter-planted with a mixture of food crops such as maize, yam, tomatoes, cassava, and groundnuts (Djagbletey & Adu-Bredu 2007).

Teak (*Tectona grandis L.f*) is a premium high-value hardwood species with unique characteristics for its attractive appearance, durability, decay resistance, and easy workability (Hallet *et al.* 2011). With its high wood quality and excellent growth performance, teak wood plantation had been one of the most preferred species for investment opportunity (Pérez 2008). Initially, teakwood plantation in Indonesia was managed by the government's enterprise, Perum Perhutani; however, in recent years there has been a gradual move away from state control of such plantation toward the participation of local people which improves local livelihoods and reduces poverty (RECOFTC 2010).

Recent campaign by several private enterprises in Indonesia to invest in teakwood plantation have been focused on quick harvesting schedule as the main selling point. This might give a misleading information to the investors since the opportunity to earn higher yield is prevented due to limited knowledge of getting optimum outcome from a better harvesting strategy. This research exercises the investment appraisal of different harvesting strategies of standalone teak plantation proposed by earlier brochures and publications (Soeroso & Poedjowadi 2009; Hallet *et al.* 2011; JAR 2012; Soeleman *et al.* 2012; Soeleman *et al.* 2013; Sugiharto 2013). It is expected that by comparing different harvesting strategies, investors are able to critically review any investment proposal that yield the best outcome which fit their valuation criteria preference.

The investment appraisal process was carried out by using the method of enterprise budget as being suggested by previous authors (Gittinger 1982; Godsey 2008; Kay *et al.* 2012). In addition to common valuation criteria of total investment, net cash flow (NCF), net present value (NPV), internal rate of return (IRR), profit on investment (P/I), and payback period (PBP); other criteria of annual equivalent value (AEV), benefit cost ratio (BCR) and composite performance index (CPI) had been applied.

Methods

The framework of this research was mainly focused on project planning, enterprise budget, financial projection, and valuation measurements to arrive at overall appraisal. Figure 1 shows the investment appraisal framework being adapted from Gittinger (1982) and Sugiharto (2013).

Gittinger (1982) did not include AEV, BCR, nor CPI which were incorporated in Sugiharto (2013). While Sugiharto (2013) compared AEV and BCR only, this article incorporates CPI to be compared with AEV and BCR. Further, each field data being used in this article was measured with additional 4 measurements compare to the data being used in Sugiharto (2013), so that the quality of data are expected to be more reliable. The financing plan that was discussed in Sugiharto (2013) is not elaborated in this article. However, the financing strategy being proposed by Sugiharto (2013) is quoted in this article.

The technical aspect, institutional aspect, and social aspect were not the focus of this research. The project planning involved the determination of location, scale of the program, timing of the activities, and manpower being employed. The enterprise budget consists of the allocation of capital investment and operating expenses as well as the calculation of revenue and its tax consequences. Price trend and inflation trend were incorporated into the valuation. Sugiharto (2013) detailed the projected enterprise budget consisting of projected income statement, projected balance sheet, and projected cash flow statement; however, for the purpose of valuation measurement, only projected cash flow statement was used.

The common valuation criteria being calculated were total investment, NCF, NPV, IRR, P/I, and PBP (Godsey 2008). To overcome any possible bias in the decision making process based on the above common valuation criteria, additional tools of AEV (Godsey 2008), BCR (Gittinger 1982), and CPI (Marimin & Maghfiroh 2010) had been employed.

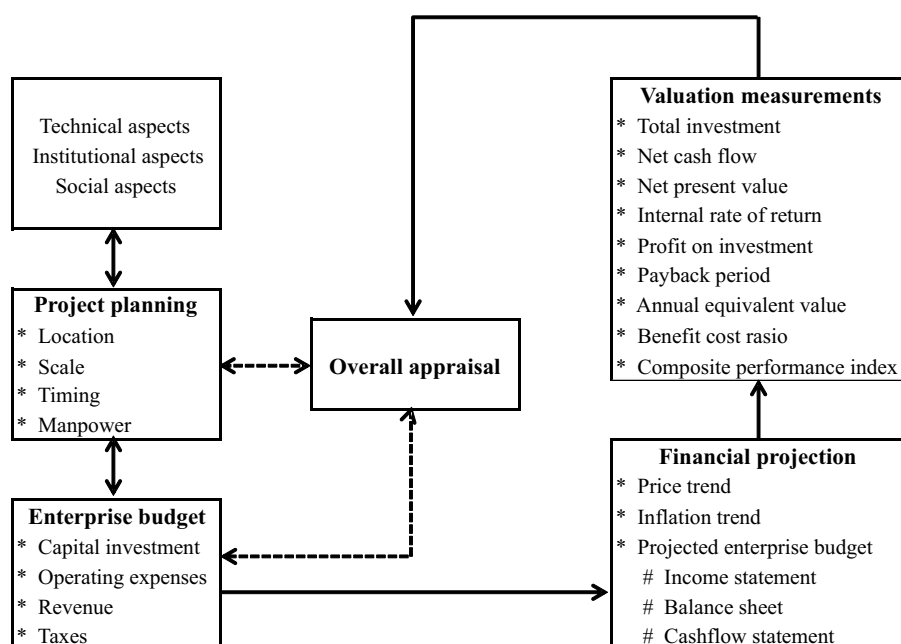


Figure 1 Research framework of investment appraisal.

Location, scale, time frame, and manpower For the purpose of the model, a field experimental research has been carried out in Gunung Kidul Regency, Yogyakarta Province, Indonesia (Figure 2). Yogyakarta Province covers an area of 3,186 km² in the mid-southern part of Java Island situated between S7°3'–8°12' and E11°00'–11°50' with the population of nearly 3.5 million. The province is divided into 5 regencies namely Kulon Progo, Bantul, Gunung Kidul, Sleman, and Kodya Yogyakarta. Gunung Kidul Regency is located between S7°46'–S8°09' and E11°21'–E11°50' covering approximately 46% of Yogyakarta Province.

An area of 5 ha was selected to the south-eastern part of Gunung Kidul Regency, located approximately 80 km to the south-east of the city of Yogyakarta. The activities were started in June 2008 and evaluated in December 2013. To carry out the activities on a 5 ha of land, 1 agricultural graduate, and 3 local farmers were employed.

Research design This research was considered as field exploratory study in which limited information on similar issues was available in the past. A noncontrived research was conducted in natural environment where the researcher's interference was minimal to moderate. Such interference included the selection of clones of teak trees, treatment, and the strategy for the start of the activities as well as the timing of harvesting. The time horizon of the study covered both cross-sectional and longitudinal studies. Face-to-face interviews carried out to gain experts' preference on valuation criteria are considered as cross-sectional study. The observation for the growth of teak's diameter and height are consired as longitudinal study in which more than one points in time being carried out in longitudinally across a period of time. The scaling mechanism being used was ordinal in which the data were rank-ordered according to some preferences.

Valuation measurement comparison In recent years, several private enterprises offering investment in teak plantation with different scenarios in term of investment value, schedule of harvesting and profit sharing. This research was focused on the valuation comparison of the following harvesting strategies:

- 1 Model 1: Company “X” offering an early harvesting of all teak plantation at the age of 5 years (Soeroso & Poedjowadi 2009).
- 2 Model 2: Company “Y” offering harvesting schedule at the age of 7 years (50%), 10 years (25%), and 13 years (25%) (JAR 2012).
- 3 Model 3: harvesting schedule at the age of 3 years (36%), 6 years (14%), 10 years (14%), 15 years (9%) and 23 years (27%) (Hallet *et al.* 2011).
- 4 Model 4: harvesting schedule after the teak trees reach an age of 14 years old to the amount of 10% each year and continues the harvesting of 10% each year until the last 10% of planted trees (Sugiharto 2013).

Except Model 1, the trees being harvested were started with the smallest diameter as part of the thinning activities to allow good quality trees grow better.

Sample design and data collection The time schedule of plantation were from June 2008 to February 2011 at a total of 4,650 trees and at the date of measurement (December 2013) there were 4,068 trees survived representing 87.5% of the planted trees. The soils range from the sandy to shally soils as well as in the karst dominated rocks. Four different clones of teak trees were planted in the middle of dry season, at the beginning of rainy season, and at the end of rainy season. The teak density were range 1,100–2,500 trees ha⁻¹ with grid spacings of 3 × 3 m and 2 × 2 m respectively. The sampling methods employed were systematic random sampling (measured in every 5 trees) and cluster sampling (based on

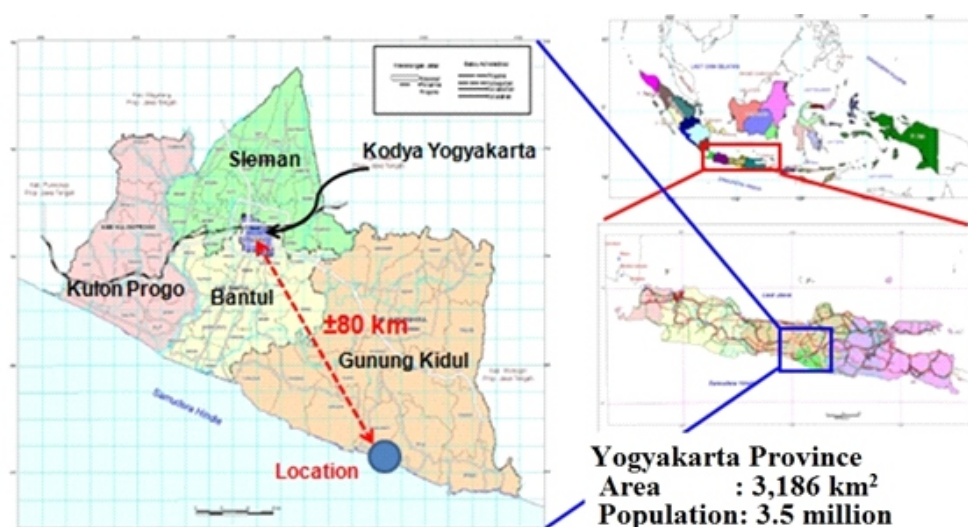


Figure 2 Research location in Gunung Kidul Regency, Yogyakarta Province, Indonesia.

the plant locations, time of plantations, and teak's clones). The data used were both primary data and secondary data. The primary data was obtained specifically designed for the purpose of the study such as direct measurement of the diameters and heights of teak trees and data were obtained through face-to-face interviews for the purpose of getting experts' preference on valuation criteria. The secondary data was obtained from the existing information such as research publications (Pérez 2008; Pramono *et al.* 2010; Hallet *et al.* 2011; Sugiharto 2013), government publications and decrees (Perhutani 2011), and brochures (Soeroso & Poedjowadi 2009; JAR 2012). From July 2011 to December 2013, 648 trees were observed at every 5 trees interval in term of their diameters (*dbh*, diameter at breast height) and heights (from the surface to free from branches). Each sample had been measured between 6–10 times at an interval of 3 months period. Before being analyzed, the samples were screened to exclude any outliers and irregularities. The first step was forecasting the trend projection of the diameter's growth of the individual sampled trees by using time series method. Further, the errors of forecasted diameters were calculated by using mean absolute deviation, mean square of error, and mean absolute error. After being screened, there were 546 reliable samples for further analysis.

Analytical tools For the purpose of investment decision-making process it is important to estimate the capital costs, operating expenses, and revenues; and to evaluate quantitatively for accepting or rejecting any proposed activity. Common quantitative methods were applied such as total investment, NCF, NPV, IRR, P/I, and PBP. Other than these commonly used evaluation techniques, 3 other techniques were applied namely AEV, BCR, and CPI.

The AEV is to estimate a level of income stream that would have the same net present value as the actual cash flows (Godsey 2008) and being defined as shown in Equation [1]:

$$AEV = \frac{NVP}{\sum_{t=1}^n \frac{1}{(1+k^*)^t}} \quad [1]$$

note: NPV = net present value
 k^* = internal rate of return

The BCR is another type of discounted measure of project in which the present worth of the benefits stream is divided by the present worth of the cost stream with the following mathematical definition (Gittinger 1982) as shown in Equation [2]:

$$BCR = \frac{\sum_{t=1}^n \frac{B_t}{(1+i)^t}}{\sum_{t=1}^n \frac{C_t}{(1+i)^t}} \quad [2]$$

note: B_t = benefit in each year
 C_t = cost in each year
 $t = 1, 2, 3, \dots, n$
 n = number of years
 i = discount rate

The CPI is one of the tools being utilized to make a decision based on performance valuation of several alternatives and several criteria (Marimin & Maghfiroh 2010). This technique was chosen to solve unequal valuation criteria and a mixture of valuation scale. There are 4 steps namely initial valuation matrix, transformed matrix, alternative values and priority ranking. After the models being valued as initial valuation matrix, the transformed matrix is defined by identifying the positive and negative trends of the criteria. For positive trend criteria, the higher the value-the better the output; whereas for negative trend criteria, the lower the value-the better the output. Further, for positive trend criteria, the minimum value is transformed to "100" and other values are transformed proportionally higher whereas for negative trend criteria, the minimum value is transformed to "100" and other values are transformed proportionally lower. After a transformed matrix is defined, a summation of all criterias multiplied by their weight factors of each model will define alternative values of the model and being rank in accordance to their preferences.

Results and Discussion

In December 2013, the age of the trees were 35–66 months which imply more data measurements compare to data being used in Sugiharto (2013). The measured diameters of the trees were 3.36–21.72 cm, and the heights were 2.0–14.00 m, respectively. The average diameters growth were 1.56–2.65 cm year⁻¹ and the average height growth were 1.15–2.34 m year⁻¹. Since the age of the teak trees were less than 6 years old, future diameters and heights of the teak were forecasted using the pattern of similar tree growth being published from the data from Costa Rica (Pérez 2008) and Indonesia (Pramono *et al.* 2010) (Figure 3).

The growth performance in diameters and heights in the first 66 months in Gunung Kidul plantation was less than that of the growth performance in Costa Rica and other part of Indonesia. Therefore, the forecasted growth of diameters and heights in Gunung Kidul was proportionally adjusted to the growth of diameters of teakwood trees in Costa Rica and other part of Indonesia.

Enterprise budget An enterprise budget provides an estimation of the potential revenue, expenses, and profit for a single enterprise. There are 3 main component of enterprise budget namely capital investment or fixed costs, operating expenses or variable costs, and revenue (Godsey 2008). Fixed costs are costs attributed to resource ownership that occur regardless of any productive activities (Godsey 2008). The capital investment for 5 ha of teakwood plantation consists of water well (IDR12,500,000 with useful life of 25 years), field camp (IDR10,000,000 with useful life of 15 years), chainshaws (IDR5,000,000 with useful life of 10 years), and other items (IDR2,500,000 with useful life of 10 years).

Operating costs are costs attributed to the productive use of resources including payments for establishment, maintenance, harvesting, and marketing (Godsey 2008). The operating costs in this research involved establishment (field

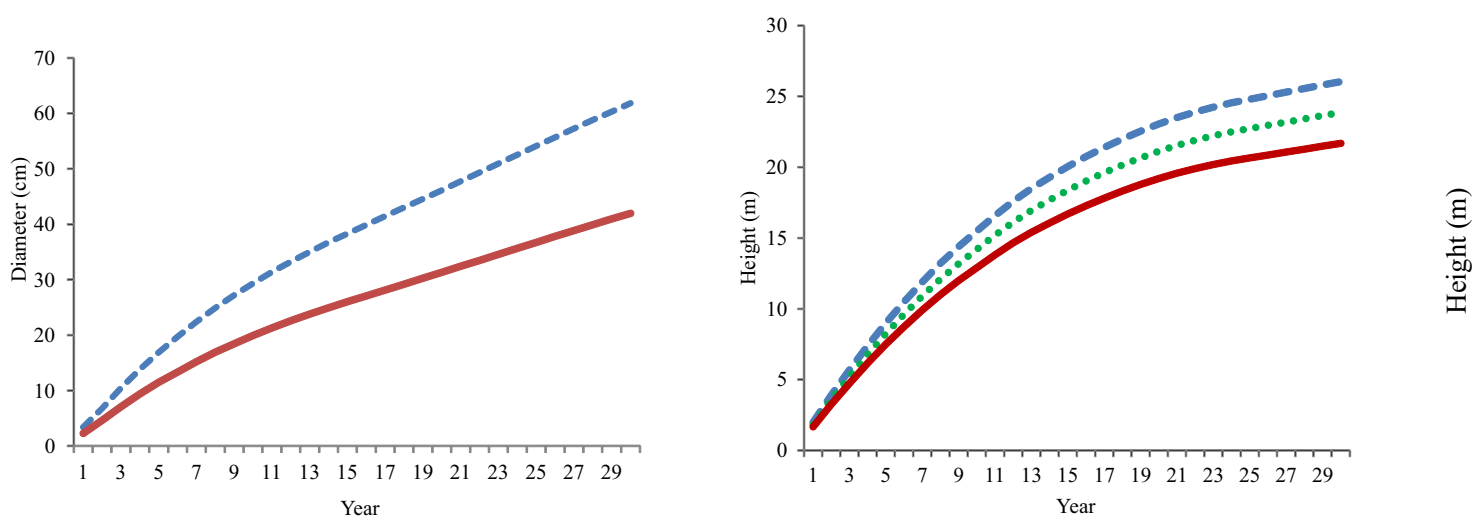


Figure 3 Forecasted diameter and height of teak wood reported by Pérez (2008) and Pramono et al. (2010). Perez (2008) (---), Pramono *et al.* (2010) (....), Own Model (—).

survey and socialization at IDR500,000 ha⁻¹, land clearing at IDR1,000,000 ha⁻¹, planting expenses at IDR1,000,000 ha⁻¹, planlet price at IDR13,500 tree⁻¹, maintenance (1 graduate professional at IDR1,750,000 person⁻¹ month⁻¹, 3 farmers at IDR850,000 person⁻¹ month⁻¹, land rental at IDR3,500,000 hectare⁻¹ year⁻¹, fertilizer at IDR750 kg⁻¹ tree⁻¹ month⁻¹, harvesting costs at IDR200,000 m⁻³, and overhead of 10% of total operating costs).

The forecasted revenue streams were calculated based on forecasted production volume and forecasted price of harvested teak wood whereas the production volume was defined from the forecasted diameter and forecasted height of teak wood plantation. The price of teak wood for the year 2012 published by Perhutani (2011) is being averaged in Table 1.

The corporate taxable income in Indonesia was calculated based on the gross income after being deducted from, among others, the costs and expenditures, depreciation and amortisation, pension fund, operating loss, unrecoverable receivable, social charity expenditures, natural disaster, education, sport, *etc.* For the purpose of this research, a fixed tax rate of 25% was applied to profit being generated from the harvested teak wood.

Financial projection From the statistic data in the last 25 years, the price of teak wood doubles every 5 years (JAR 2012). This is equivalent to approximately 15% increases year⁻¹ which was used to evaluate the models. For the purpose of the research, an inflation of 6% were used. Sugiharto (2013) elaborated the projected income statement, projected balance sheet, and projected cash flow statement; however, for the purpose of this paper only projected cash flow statement was used.

Valuation measurement An in-depth interviews with experts representing the board of a public company,

individual investor, and an executive of a private company were carried out. Experts' preferences were valued between 1 (the lowest) and 5 (the most preferred). Sugiharto (2013) indicated that from the interviews, the IRR criteria was the highest criteria considered by all respondents with an average weight factor of 0.25. This criterium was followed by NCF and P/I criteria with an average weight factor of 0.20. The NPV and PBP share the same weight factor of 0.15 whereas the weight factor of total investment is 0.05.

One of the critical issue to be used for valuation measurement is the determination of required rate of return. The required rate of return or discount rate being used for financial valuation was calculated using the formula $E(R_f) = R_f + \beta_i (R_m - R_f)$. The risk-free rate " R_f " was taken from the government's long term loan being issued by the Government of Indonesia (Minister of Finance 2012) whereas the " β " (being defined as the ratio of the variability on the common stocks of the firm to the variability in the average return on the common stocks of all firms; Salvatore 2008) was taken by averaging all available " β " data of public companies in agriculture being listed in Indonesia (Reuters 2013). ($R_m - R_f$) is market risk premium in Indonesia (Fernández *et al.* 2011). The calculated required rate of return was 11.71 and, therefore, for the purpose of this research, the required rate of return of 12% was used (Sugiharto 2013).

Valuation results The valuation of Model 1, Model 2, Model 3, and Model 4 were compared in term of total investment, NCF, NPV at a discount rate of 12%, IRR, P/I, and PBP. The valuation output of the above models is demonstrated in Table 2.

From the valuation, Model 1 is superior in terms of lowest total investment (i.e. IDR610.91 million) and the fastest payback period (i.e. 5.92 years) whereas Model 3 superior in terms of highest profit on investment (i.e. 335.29). In terms of NCF, NPV, and IRR, Model 4 is the best yielding an NCF of

Table 1 Average teak price per m³ for the year 2012

Diameter (cm)	Price per m ³ (IDR)
4–7	767,500
10–13	1,509,500
16–19	2,366,500
21–23	2,937,200
24–26	3,534,600
27–29	4,032,200
30–34	5,541,167
35–39	6,234,000
40–44	6,926,667
45–49	7,619,167
50–54	8,311,833
55–59	9,004,500
60–64	9,904,833
65–69	10,805,333

Table 2 Valuation comparison of the models

	Investment (million IDR)	NCF (million IDR)	NPV (million IDR)	IRR (%)	P/I	PBP (years)
Model 1	610.91	170.66	(75.95)	6.83	0.28	5.92
Model 2	879.60	2,020.96	407.74	21.38	2.30	10.03
Model 3	961.33	322,330.28	20,741.98	34.47	335.29	16.00
Model 4	2,019.13	364,458.81	26,625.94	35.85	180.50	16.09

Table 3 The CPI, AEV, and BCR methods

	Transformed Matrix						Alternate Value	Rank	AEV (million IDR)	BCR
	Investment	NCF	NPV	IRR	P/I	PBP				
Model 1	100	100	100	100	100	100	100	4	(15.29)	0.88
Model 2	69	1,184	268	313	821	59	532	3	58.47	1.39
Model 3	64	188,873	13,655	505	119,746	37	63,907	1	2,627.01	16.14
Model 4	30	213,558	17,529	525	64,464	37	58,372	2	3,372.22	19.94
Weight	0.05	0.20	0.15	0.25	0.20	0.15				

IDR364,458.81 million, an NPV of IDR26,625.94 million, and an IRR of 35.85% at the expense of highest total investment (i.e. IDR2,019.13 million) and longest payback period (i.e. 16.09 years). To overcome a long period of *PBP*, Sugiharto (2013) proposed a financing strategy in which three stages were proposed. The first stage being developed by initiator would result in a long period of payback unless the second stage was introduced. The second stage being proposed was private placement so that the initiator would

recover its investment with profit in year four. Further, stage three being proposed by Sugiharto (2013) at year 6 was public offering so that the private placement party will recover its investment and profit in two years time. As a public company, shareholders are able to trade their shares at any time independence to harvesting time (Sugiharto 2013).

The output of the valuation in Table 2 was analysed further by using CPI, AEV, and BCR methods (Table 3). This table indicates that Model 3 is the most preferred alternative

with an alternate value of 63,907 being followed by Model 4 with an alternate value of 58,372; whereas Model 1 and Model 2 that represent early harvesting schedules earn the lowest preferred rank with alternate values of 100 and 532, respectively.

In terms of AEV, Model 4 gave the best outcome at a value of IDR3,372.22 million being followed with Model 3 at a value of IDR2,627.01 million. The AEV of Model 1 was a lost at a value of IDR15.29 million, whereas the AEV of Model 2 was IDR58.47 million. The AEV results were consistent with the BCR results in which Model 4 is the best with a BCR of 19.94 being followed with Model 3 with a BCR of 16.14. Model 3 yield a BCR of 1.39 whereas Model 1 yield a BCR of 0.88 respectively. Again, the BCR of 0.88 in Model 1 indicates that the benefit of the model is less than the costs being spent.

Conclusion

It is concluded that despite the fastest payback period and lowest investment, Model 1 yields a negative NPV, negative AEV, and a benefit that less than the costs. This is supported with the lowest preferred rank of the CPI analysis. Model 3 and Model 4 that represent longer harvesting schedules yield better outcomes. In term of financing strategy, the long payback period due to longer harvesting schedules could be overcome by private placement and public offering. The preference on Model 3 and Model 4 is depend on the individual investor's criteria. For investors that more concern on less total investment and highest profit on investment, Model 3 is the best choice; however, for investors that more concern on net cash flow, net present value, and internal rate of return, Model 4 gives the best outcome. In general, AEV, BCR, and CPI are consistent to support the other common valuation criteria. Therefore, investors should carefully evaluate any investment opportunity being offered by private enterprises by applying other supporting methods as well as applying proper financing strategy to ensure the best outcome of the investment.

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